

What is claimed is:

1. A high-reactivity polyurethane composition containing uretdione groups and essentially comprising

5 A) at least one uretdione-containing curing agent which is based on aromatic, aliphatic, (cyclo)aliphatic or cycloaliphatic polyisocyanates and hydroxyl-containing compounds and has a free NCO content of less than 5% by weight and a uretdione content of 1-18% by weight,

10 B) if desired, a hydroxyl-containing or amino-containing polymer having an OH number of between 20 and 500 mg KOH/gram or a comparable amine content,

15 C) at least one catalyst of the formula $[PR^1R^2R^3R^4]^+ [R^5]^-$, where R^1 - R^4 simultaneously or independently of one another are alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being in each case linear or branched, unbridged or bridged with other radicals R^1 - R^4 , to form monocyclic, bicyclic or tricyclic systems, it being possible for the bridging atoms to be not only carbon but
20 also heteroatoms and, additionally for each radical R^1 - R^4 to have one or more alcohol, amino, ester, keto, thio, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms, and R^5 is either OH or F or R^6COO where R^6 is alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being linear or branched and additionally may have one or more alcohol, amino, ester, keto, thio,
25 acid, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms,

such that the fraction of the catalyst under C) is 0.001-5% by weight of the total amount of components A) and B).

2. A polyurethane composition as claimed in claim 1, comprising

D) at least one compound which is reactive toward acid groups and has a weight fraction, based on the total formulation, of from 0.1 to 10%,
and/or

30 E) at least one acid in monomeric or polymeric form, in a weight fraction, based on the total formulation, of from 0.1 to 10%.

3. A polyurethane composition as claimed in claim 1 or 2, comprising solvents F) and/or auxiliaries and additives.
- 5 4. A polyurethane composition as claimed in at least one of claims 1 to 3, comprising uretdione-containing curing agents A) based on isophorone diisocyanate (IPDI), hexamethylene diisocyanate (HDI), 2-methylpentane diisocyanate (MPDI), 2,2,4-trimethylhexamethylene diisocyanate/2,4,4-trimethylhexamethylene diisocyanate (TMDI), norbornane diisocyanate (NBDI), methylenediphenyl diisocyanate (MDI),
10 toluidine diisocyanate (TDI) and tetramethylxylylene diisocyanate (TMXDI), alone or in mixtures.
5. A polyurethane composition as claimed in claim 4, comprising uretdione-containing curing agents based on IPDI and/or HDI.
- 15 6. A polyurethane composition as claimed in at least one of claims 1 to 5, comprising uretdione-containing curing agents A) based on hydroxyl-containing polyesters, polythioethers, polyethers, polycaprolactams, polyepoxides, polyesteramides, polyurethanes, low molecular mass di-, tri- and/or tetraalcohols, monoamines and/or
20 monoalcohols, alone or in mixtures.
7. A polyurethane composition as claimed in claim 6, comprising polyesters and/or monomeric dialcohols.
- 25 8. A polyurethane composition as claimed in at least one of claims 1 to 7, comprising as hydroxyl-containing polymers B) polyesters, polyethers, polyacrylates, polyurethanes and polycarbonates, alone or in mixtures.
- 30 9. A polyurethane composition as claimed in claim 8, comprising polyesters having an OH number of from 30 to 150 mg KOH/g and an average molecular weight of from 500 to 6000 g/mol.

10. A polyurethane composition as claimed in at least one of claims 1 to 9, wherein catalysts C) are selected from tetrabutylphosphonium acetate, tetrabutylphosphonium benzotriazolate, tetrabutylphosphonium hydroxide, ethyltriphenylphosphonium acetate, tetraphenylphosphonium phenoxide, trihexyltetradecylphosphonium decanoate and tetrabutylphosphonium fluoride.
11. A polyurethane composition as claimed in at least one of claims 1 to 10, comprising tributylphosphonium hydroxide as catalyst C).
12. A polyurethane composition as claimed in at least one of claims 1 to 11, comprising as component D) epoxy compounds, carbodiimides, hydroxyalkylamides, basic salts and/or 2-oxazolines.
13. A polyurethane composition as claimed in claim 12, comprising triglycidyl ether isocyanurate, EPIKOTE 828[®], Versatic acid glycidyl esters, Vestagon EP HA 320, phenylenebisoxazoline, 2-methyl-2-oxazoline, 2-hydroxyethyl-2-oxazoline, 2-hydroxypropyl-2-oxazoline and/or 5-hydroxypentyl-2-oxazoline, sodium carbonate or calcium carbonate, alone or in mixtures.
14. A polyurethane composition as claimed in at least one of claims 1 to 13, comprising as acid E) sulfuric acid, acetic acid, benzoic acid, malonic acid or terephthalic acid or else copolyesters or copolyamides having an acid number of at least 20.
15. A process for preparing a high-reactivity polyurethane composition containing uretdione groups and essentially comprising
- A) at least one uretdione-containing curing agent which is based on aromatic, aliphatic, (cyclo)aliphatic or cycloaliphatic polyisocyanates and hydroxyl-containing compounds and has a free NCO content of less than 5% by weight and a uretdione content of 1-18% by weight,
- B) if desired, a hydroxyl-containing and/or amino-containing polymer having an OH

number of between 20 and 500 mg KOH/gram or a comparable amine content,

5 B) at least one catalyst of the formula $[PR^1R^2R^3R^4]^+ [R^5]^-$, where R^1 - R^4 simultaneously or independently of one another are alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being in each case linear or branched, unbridged or bridged with other radicals R^1 - R^4 , to form monocyclic, bicyclic or tricyclic systems, it being possible for the bridging atoms to be not only carbon but also heteroatoms and, additionally for each radical R^1 - R^4 to have one or more alcohol, amino, ester, keto, thio, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms, and R^5 is either OH or F or R^6COO where R^6 is alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being linear or branched and additionally may have one or more alcohol, amino, ester, keto, thio, acid, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms,

15 such that the fraction of the catalyst under C) is 0.001-5% by weight of the total amount of components A) and B), by homogenization.

16. The use of at least one catalyst of the formula $[PR^1R^2R^3R^4]^+ [R^5]^-$, where R^1 - R^4 simultaneously or independently of one another are alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being in each case linear or branched, unbridged or bridged with other radicals R^1 - R^4 , to form monocyclic, bicyclic or tricyclic systems, it being possible for the bridging atoms to be not only carbon but also heteroatoms and, additionally, for each radical R^1 - R^4 to have one or more alcohol, amino, ester, keto, thio, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms, and R^5 is either OH or F or R^6COO where R^6 is alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being linear or branched and additionally may have one or more alcohol, amino, ester, keto, thio, acid, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms in polyurethane compositions.

30 17. The use as claimed in claim 16, wherein compounds selected from tetrabutylphosphonium acetate, tetrabutylphosphonium benzotriazolate,

tetrabutylphosphonium hydroxide, ethyltriphenylphosphonium acetate, tetraphenylphosphonium phenoxide, trihexyltetradecylphosphonium decanoate and/or tetrabutylphosphonium fluoride are used.

- 5 18. A catalyst for accelerating the curing of a polyurethane composition, essentially comprising a uretdione-containing curing agent and a hydroxyl-containing polymer, of the formula $[PR^1R^2R^3R^4]^+ [R^5]^-$, where R^1 - R^4 simultaneously or independently of one another are alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being in each case linear or branched, unbridged or bridged with other radicals
10 R^1 - R^4 , to form monocyclic, bicyclic or tricyclic systems, it being possible for the bridging atoms to be not only carbon but also heteroatoms and, additionally, for each radical R^1 - R^4 to have one or more alcohol, amino, ester, keto, thio, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms, and R^5 is either OH or F or R^6COO where R^6 is alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon
15 atoms and being linear or branched and additionally may have one or more alcohol, amino, ester, keto, thio, acid, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms.

19. A catalyst as claimed in 18, selected from tetrabutylphosphonium acetate,
20 tetrabutylphosphonium benzotriazolate, tetrabutylphosphonium hydroxide, ethyltriphenylphosphonium acetate, tetraphenylphosphonium phenoxide, trihexyltetradecylphosphonium decanoate and/or tetrabutylphosphonium fluoride.

20. A catalyst as claimed in claim 19, consisting of tetrabutylphosphonium hydroxide.
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21. The use of a polyurethane composition essentially comprising
A) at least one uretdione-containing curing agent which is based on aromatic, aliphatic, (cyclo)aliphatic or cycloaliphatic polyisocyanates and hydroxyl-containing compounds and has a free NCO content of less than 5% by weight and a uretdione
30 content of 1-18% by weight,
B) if desired, a hydroxyl-containing and/or amino-containing polymer having an OH

number of between 20 and 500 mg KOH/gram or a comparable amine content,

5 B) at least one catalyst of the formula $[PR^1R^2R^3R^4]^+ [R^5]^-$, where R^1 - R^4 simultaneously or independently of one another are alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being in each case linear or branched, unbridged or bridged with other radicals R^1 - R^4 , to form monocyclic, bicyclic or tricyclic systems, it being possible for the bridging atoms to be not only carbon but also heteroatoms and, additionally for each radical R^1 - R^4 to have one or more alcohol, amino, ester, keto, thio, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms, and R^5 is either OH or F or R^6COO where R^6 is alkyl, aryl, 10 aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being linear or branched and additionally may have one or more alcohol, amino, ester, keto, thio, acid, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms,

such that the fraction of the catalyst under C) is 0.001-5% by weight of the total amount of components A) and B), for preparing liquid and pulverulent coating and adhesive 15 compositions.

22. The use as claimed in claim 21, wherein starting compounds as set forth in at least one of claims 2 to 14 are present.

20 23. The use as claimed in claim 21 or 22 for preparing liquid and pulverulent coating and adhesive compositions for metal, plastic, wood, glass, leather or other heat-resistant substrates.

25 24. A metal-coating composition essentially comprising a polyurethane composition comprising

A) at least one uretdione-containing curing agent which is based on aromatic, aliphatic, (cyclo)aliphatic or cycloaliphatic polyisocyanates and hydroxyl-containing compounds and has a free NCO content of less than 5% by weight and a uretdione 30 content of 1-18% by weight,

B) if desired, a hydroxyl-containing or amino-containing polymer having an OH number

of between 20 and 500 mg KOH/gram or a comparable amine content,

C) at least one catalyst of the formula $[PR^1R^2R^3R^4]^+ [R^5]^-$, where R^1 - R^4 simultaneously or independently of one another are alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being in each case linear or branched, unbridged or bridged with other radicals R^1 - R^4 , to form monocyclic, bicyclic or tricyclic systems, it being possible for the bridging atoms to be not only carbon but also heteroatoms and, additionally for each radical R^1 - R^4 to have one or more alcohol, amino, ester, keto, thio, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms, and R^5 is either OH or F or R^6COO where R^6 is alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being linear or branched and additionally may have one or more alcohol, amino, ester, keto, thio, acid, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms,

such that the fraction of the catalyst under C) is 0.001-5% by weight of the total amount of components A) and B).

25. A wood-coating composition essentially comprising a polyurethane coating composition comprising

A) at least one uretdione-containing curing agent which is based on aromatic, aliphatic, (cyclo)aliphatic or cycloaliphatic polyisocyanates and hydroxyl-containing compounds and has a free NCO content of less than 5% by weight and a uretdione content of 1-18% by weight,

B) if desired, a hydroxyl-containing or amino-containing polymer having an OH number of between 20 and 500 mg KOH/gram or a comparable amine content,

C) at least one catalyst of the formula $[PR^1R^2R^3R^4]^+ [R^5]^-$, where R^1 - R^4 simultaneously or independently of one another are alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being in each case linear or branched, unbridged or bridged with other radicals R^1 - R^4 , to form monocyclic, bicyclic or tricyclic systems, it being possible for the bridging atoms to be not only carbon but also heteroatoms and, additionally for each radical R^1 - R^4 to have one or more alcohol, amino, ester, keto, thio, urethane, urea or allophanate groups, double bonds, triple

bonds or halogen atoms, and R^5 is either OH or F or $R^6\text{COO}$ where R^6 is alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being linear or branched and additionally may have one or more alcohol, amino, ester, keto, thio, acid, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms,

such that the fraction of the catalyst under C) is 0.001-5% by weight of the total amount of components A) and B).

26. A leather-coating composition essentially comprising a polyurethane coating composition comprising

A) at least one uretdione-containing curing agent which is based on aromatic, aliphatic, (cyclo)aliphatic or cycloaliphatic polyisocyanates and hydroxyl-containing compounds and has a free NCO content of less than 5% by weight and a uretdione content of 1-18% by weight,

B) if desired, a hydroxyl-containing or amino-containing polymer having an OH number of between 20 and 500 mg KOH/gram or a comparable amine content,

C) at least one catalyst of the formula $[\text{PR}^1\text{R}^2\text{R}^3\text{R}^4]^+ [\text{R}^5]^-$, where $\text{R}^1\text{-R}^4$ simultaneously or independently of one another are alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being in each case linear or branched, unbridged or bridged with other radicals $\text{R}^1\text{-R}^4$, to form monocyclic, bicyclic or tricyclic systems, it being possible for the bridging atoms to be not only carbon but also heteroatoms and, additionally for each radical $\text{R}^1\text{-R}^4$ to have one or more alcohol, amino, ester, keto, thio, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms, and R^5 is either OH or F or R^6COO where R^6 is alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being linear or branched and additionally may have one or more alcohol, amino, ester, keto, thio, acid, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms,

such that the fraction of the catalyst under C) is 0.001-5% by weight of the total amount of components A) and B).

27. A plastics-coating composition essentially comprising a polyurethane composition comprising

A) at least one uretdione-containing curing agent which is based on aromatic, aliphatic, (cyclo)aliphatic or cycloaliphatic polyisocyanates and hydroxyl-containing compounds and has a free NCO content of less than 5% by weight and a uretdione content of 1-18% by weight,

B) if desired, a hydroxyl-containing or amino-containing polymer having an OH number of between 20 and 500 mg KOH/gram or a comparable amine content,

C) at least one catalyst of the formula $[PR^1R^2R^3R^4]^+ [R^5]^-$, where R^1 - R^4 simultaneously or independently of one another are alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being in each case linear or branched, unbridged or bridged with other radicals R^1 - R^4 , to form monocyclic, bicyclic or tricyclic systems, it being possible for the bridging atoms to be not only carbon but also heteroatoms and, additionally for each radical R^1 - R^4 to have one or more alcohol, amino, ester, keto, thio, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms, and R^5 is either OH or F or R^6COO where R^6 is alkyl, aryl, aralkyl, heteroaryl or alkoxyalkyl radicals having 1-18 carbon atoms and being linear or branched and additionally may have one or more alcohol, amino, ester, keto, thio, acid, urethane, urea or allophanate groups, double bonds, triple bonds or halogen atoms,

such that the fraction of the catalyst under C) is 0.001-5% by weight of the total amount of components A) and B).

28. A metal coating as set forth in claim 24 for automobile bodies, motorbikes and cycles, architectural components and household appliances.

29. A coating composition as claimed in one of claims 24 to 28, comprising at least one of components D) to G).

30. A coating composition as claimed in one of claims 24 to 29, comprising compounds as set forth in at least one of claims 2 to 14.